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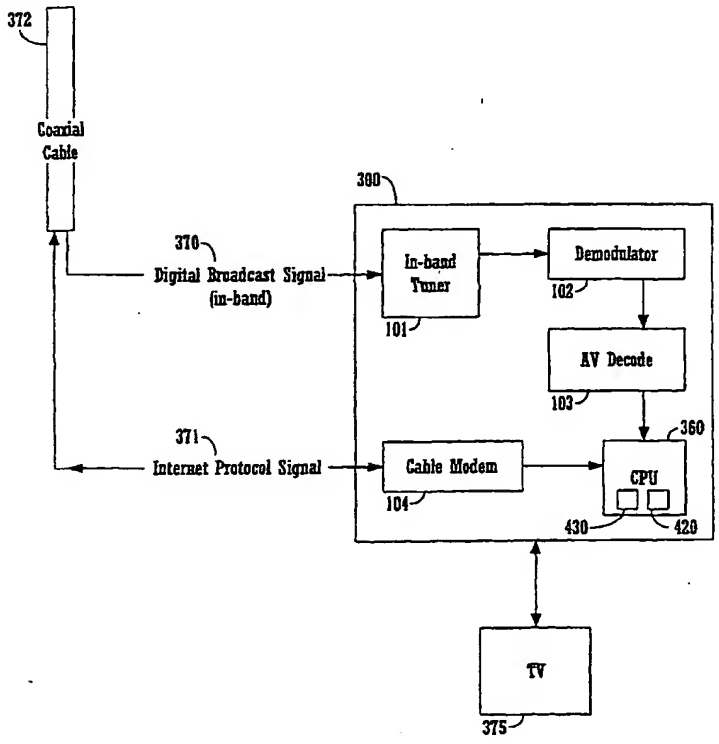


(57) Abstract: A bi-directional transceiver for seamlessly combining internet information with video information to create an interactive display interface for viewing by a user is disclosed. The transceiver includes an in-band tuner for receiving a digital broadcast signal and generating a data stream therefrom. The in-band tuner is coupled to an audio video decoder for decoding the data stream into a resulting video signal. The transceiver also includes a cable modem for implementing bi-directional communication using internet protocols. The operation of the in-band tuner the audio video decoder and the cable modem is managed and coordinated by a CPU. The CPU is a component having a digital processor coupled to a memory. The memory is for storing computer readable code which when executed by the processor cause the transceiver to perform the functions required to create the interactive display for the user. In creating display, a display interface is generated including video from the video signal and a web page from the cable modem. The display interface signal is coupled to a monitor for viewing by the user. The transceiver recognizes user input as the user interacts with elements of the display interface. The user input is transmitted upstream using the cable modem.

WO 01/50740 A1

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# A METHOD AND SYSTEM FOR A BI-DIRECTIONAL TRANSCEIVER

## FIELD OF THE INVENTION

The present invention relates to the field of intelligent transceivers such as bi-directional set-top boxes used by the cable television industry. More specifically, the present invention pertains creating an interactive display interface using a bi-directional transceiver. In one aspect, the present invention relates to a method and system for a bi-directional transceiver for combining internet information with video information to create an interactive display interface.

## BACKGROUND ART

Digital broadcast systems include direct broadcast digital satellite systems, interactive World Wide Web ("Web") access systems, and digital cable systems. Digital broadcasting provides a number of advantages to subscribers, such as variety and flexibility of programming, useful and comprehensive support services (such as detailed electronic programming guides), and superior audio and video quality. The advanced electronics of digital broadcast systems provides for a greatly increased number of viewing choices. These choices include, for example, a much larger number of channels to choose from, a much larger number of pay-per-view movies, televised sporting events, music, and the like. Broadcasting often occurs 24 hours each day, on each channel, in a continuous fashion. The trend for increased viewing

choices is accelerating. As the amount of available bandwidth into a user's home increases, the viewing choices available to the user proliferates.

There is a problem, however, in that the viewer has limited information to assist in and organizing and utilizing the available AV choices and taking advantage of their features. Many users have a limited amount time in order to view their desired programming. For example, in a typical broadcasting implementation, much of the premium content being broadcast is not available "in the clear," or free of charge. For example, a premium sporting event (e.g., a boxing match) is broadcast using conditional access functionality to ensure payment for the premium sporting event is received. The Conditional Access (CA) function of a digital broadcast system allows selective access to valuable copyrighted programming. Such programming includes, for example, pay-per view movies, premium sporting events, etc. Hence, users need to carefully choose their desired programming in light of, for example, their budget requirements, viewing preferences, available programming, and the like.

Traditional viewing assistance guides have proven to be of limited value to many users. One example is the traditional print based "television guide." In its most primitive forms, the television guide is basically printed information, page upon page, describing the content of the various broadcast channels usually available in the user's area. In its slightly more advanced forms, the television guide is electronically based, often transmitted along with the digital broadcast information on one channel of the cable television station, or on one channel of a satellite television network. The user scrolls through the television guide to determine what time a desired program is being broadcast. The user then makes decisions regarding whether to make time to watch the

program, set a recording device to record program, or ignore the program and hopefully view it at a subsequent broadcast time, etc.

Finding the correct information and/or the correct programming out of all of the available information and programming, and determining whether the desired information/programming is being broadcast at the desired time has proven quite problematic for most users. As described above, the number of available viewing/listening choices is proliferating. Many cable television systems are capable of carrying a hundred channels or more. Satellite television systems are often capable of providing 500 or more channels.

To take best advantage of the available viewing/listening choices, a more modern method of presenting information regarding the broadcast data and presenting information regarding the viewing/listening choices available to the user is required. A simple printed television guide is not sufficient. Simply browsing through pages of a printed guide, hunting for some program of interest, is not an efficient or smart use of the capabilities of a modern home AV system. Even the more advanced electronically based television guides are not sufficiently helpful. As is often the case, with such prior art electronic programming guides, instead of browsing through printed pages of information hunting for program of interest, a user is forced to browse through electronic pages (often fuzzy images displayed on a television screen) hunting for information.

SUMMARY

Accordingly, what is required is a system for presenting information regarding broadcast data available to a user with a home transceiver (e.g., set-top box). What is required is a system for generating a comprehensive interface which allows the user to efficiently analyze and sift through the various viewing/listening choices available. The required system should be capable of providing active assistance to the user in identifying choices of interest. What is required is a system which can recognize user input as the user identifies choices of interest and selects programming the user finds interesting. The required system should be intelligent and be capable of taking predetermined actions based upon the user history, interests, etc. The required system should be intuitively obvious to use.

The present invention provides a novel method and system that satisfies the above requirements. These and other advantages of the present invention not specifically mentioned above will become clear within discussions of the present invention presented herein.

In one embodiment, the present invention is implemented as a bi-directional cable television set-top box transceiver for seamlessly combining internet information with video information to create an interactive display interface for viewing by a user. In this embodiment, the transceiver includes a single in-band tuner (as opposed to multiple tuners) for receiving an "in-band" digital broadcast signal and generating a data stream (e.g., an MPEG based data stream) therefrom. The in-band tuner is coupled to an audio video decoder for decoding the data stream into a resulting video signal (e.g., for display on a

coupled television monitor). The transceiver also includes a cable modem for implementing bi-directional communication using internet protocols.

The operation of the in-band tuner, the audio video decoder, and the cable modem is managed and coordinated by a CPU (central processing unit). The CPU is a component having a digital processor coupled to a memory. In this embodiment, much of the display interface generation is software based, in that much of the functionality embodied by the display interface is implemented via software executing on the CPU. The memory stores the software and provides the execution environment for implementing the functionality of the interactive display interface generation process performed by the transceiver.

The display interface is generated such that it includes video information from the video signal (e.g., a digital broadcast channel received via cable) and Internet information (e.g., a web page created specifically for the particular digital broadcast channel) from the cable modem. The video information and the Internet information are seamlessly combined into an attractive, intuitive display interface (e.g., as seen by the user on, for example, the externally coupled television). As the user interacts with the display interface, the transceiver recognizes user input as the user interacts with, for example, specific elements of the display interface with a remote control joystick or buttons. The user input is transmitted upstream using the cable modem, and the display interface is altered in accordance with the user input, if required (e.g., the user selects a new channel for viewing). Additionally, any descrambling keys required for descrambling premium content (e.g., premium sporting events, etc.) can be delivered via the cable modem.

In this manner, the transceiver of the present invention provides a display interface which efficiently presents information regarding broadcast data available to a user. By combining information from the Internet with an actual video signal in a single display, the transceiver of the present invention provides a comprehensive display interface which allows the user to efficiently analyze and sift through the various viewing/listening choices available. For example, the user is able to access an unlimited number of web pages specifically tailored to each available viewing or listening choice.

The web pages would include information regarding programming availability, cost (if any), program specific information describing the actual content of program (e.g., synopsis, summary, rating guide, etc.), or the like. Since much of the functionality of the display interface is software based, the transceiver is capable of providing active assistance to the user in identifying choices of interest, and can recognize the user identifying choices of interest and display additional programming the user would find interesting. In so doing, the transceiver of the present invention is intelligent and capable of taking predetermined actions based upon the user history, interests, etc., and is intuitively obvious to use.

In an alternative embodiment, the transceiver includes both an in-band tuner and an out-of-band tuner for receiving digital broadcast signals. A cable modem is also included for providing bi-directional Internet connectivity.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

Figure 1 shows an overview diagram of a transceiver in accordance with one embodiment of the present invention.

Figure 2 shows a diagram of the elements of a display interface in accordance with one embodiment of present invention.

Figure 3A shows an overview diagram depicting the relationship between a transceiver and the broadcast means of a digital broadcast system operator in accordance with one embodiment of the present invention.

Figure 3B is an illustration of the various frequencies associated with the in-band signals and out-of-band signals of the digital broadcast signal and the cable modem signal in accordance with one embodiment of the present invention.

Figure 4 shows a more detailed diagram of a transceiver in accordance with one embodiment of present invention.

Figure 5 shows a block diagram of a transceiver in accordance with another embodiment of the present invention.

Figure 6 shows a more detailed block diagram of a transceiver in accordance with yet another embodiment of present invention.

Figure 7 shows a flow chart of the steps of an interactive display generation process in accordance with one embodiment of present invention as implemented using a transceiver in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION

Reference will now be made in detail to the embodiments of the invention, a method and system for a bi-directional transceiver for combining Internet information with video information to create an interactive display interface, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present invention.

Embodiments of the present invention are directed to a method and system for a bi-directional transceiver that combines Internet information with video information to create an interactive display interface for viewing by a user. The present invention generates a comprehensive display interface which allows the user to efficiently analyze and sift through the various viewing/listening choices available. The display interface of the present invention is interactive and is capable of providing active assistance to the user in identifying choices of interest. Through the display interface, the

transceiver of present invention can recognize user input as the user identifies choices of interest and selects programming the user finds interesting. In addition, the transceiver of the present invention is intelligent and capable of taking predetermined actions based upon the user history, interests, etc., and is intuitively obvious to use. The present invention and its benefits are further described below.

Notation and Nomenclature

Some portions of the detailed descriptions which follow are presented in terms of procedures, steps, logic blocks, processing, and other symbolic representations of operations on data bits within a computer memory. These descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. A procedure, computer executed step, logic block, process, etc., is here, and generally, conceived to be a self-consistent sequence of steps or instructions leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated in a computer system. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, it is appreciated that

throughout the present invention, discussions utilizing terms such as "processing" or "computing" or "transmitting" or "encrypting" or "determining" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

The Transceiver of the Present Invention

The present invention is described in the context of an interactive display interface generated by an intelligent transceiver (e.g., a set-top box) that can be used as part of a bi-directional digital broadcast system. However, it is appreciated that the present invention may be utilized in other types of devices, including consumer electronic devices, where it may be necessary to generate an interactive display interface.

Referring now to Figure 1, an overview diagram of a transceiver 300 in accordance with one embodiment of the present invention is shown. Transceiver 300 includes a single in-band tuner 101, a demodulator 102, an AV (audio video) decode block 103, a cable modem 104, and a CPU 360. The in-band tuner 101 is coupled to receive a digital broadcast signal 370. The cable modem 104 is coupled to receive and transmit Internet protocol signal 371. Transceiver 300 is also coupled to a television 375. In this embodiment, digital broadcast signal 370 and Internet protocol signal 371 are both transmitted via a coaxial cable 372. Additionally, in this embodiment, the A/V decode block 103 includes functionality for descrambling the incoming digital broadcast signal

370. In this embodiment, transceiver 300 is used to implement a cable television set-top box.

It should be appreciated that in the present embodiment, transceiver 300 includes a single in-band tuner 101, however, in other embodiments (e.g., transceiver 600 of Figure 6), additional tuners can be included to receive additional signals (e.g., out-of-band tuner 402 of Figure 6).

In accordance with present embodiment, transceiver 300 implements a bi-directional interactive display interface for viewing by a user via television 375. The display interface implemented by transceiver 300 is bi-directional in the sense that downstream information is received via digital broadcast signal 370 and via Internet protocol signal 371 from, for example, the cable television service provider, and information is received from the user and transmitted upstream back to, for example, the cable television service provider, via the cable modem 104.

Referring still to Figure 1, the display interface transmitted to and displayed on television 375 functions in part as a seamless combination of Internet information and video information that provides the user with an efficient guide that assists the user in identifying programming choices of interest and associated information. In this embodiment, the in-band tuner 101 functions by tuning and receiving the digital broadcast signal 370. Digital broadcast signal 370 is demodulated into a scrambled data stream using the coupled demodulator 102. The data stream is scrambled to prevent unauthorized access and to implement a conditional access system. The scrambled data stream is received by AV decode block 103 where it is

descrambled and decoded into, for example, an MPEG based data stream. In this embodiment, AV decode block 103 further processes the data stream signal into a display signal compatible for display on the coupled television 375.

The transceiver 300 also includes a cable modem 104 for implementing bi-directional communication using internet protocols. Cable modem 104 uses well known Internet protocols for both transmitting information upstream via a coaxial cable 372 and for receiving downstream information (e.g., via Internet protocol signal 371). Cable modem 104 is coupled to CPU 360, thereby allowing software programs (e.g., Web browsers) hosted on CPU 360 to access and interact with Web sites on the Internet.

The operation of the in-band tuner 101, the demodulator 102, the AV decode block 103, and the cable modem 104 is managed and coordinated by CPU 360. The CPU 360 is a component having a digital microprocessor 430 coupled to a memory 420. In this embodiment, much of the display interface generation of the present invention is software based, in that much of the functionality embodied by the display interface is implemented via software executing on the CPU 360. For example, the memory 420 stores the software and provides the execution environment for implementing the functionality of the interactive display interface generation process performed by the transceiver 300. Additionally, any descrambling keys required for descrambling premium content (e.g., premium sporting events, etc.) can be delivered via the cable modem 104.

Referring still to Figure 1, the display interface is generated such that it includes video information from the video signal (e.g., a digital broadcast signal

370 received via cable 372) and Internet information (e.g., a web page created specifically for the particular digital broadcast channel) from the cable modem 104. The video information and the Internet information are seamlessly combined into an attractive, intuitive display interface. The display interface is seen by the user on the display (e.g., the TV screen) of the coupled television 375.

Referring now to Figure 2, a diagram showing the elements of a display interface 376 in accordance with one embodiment of the present invention is shown. As described above, in this embodiment, display interface 376 is seen by the user on the screen of television 375.

In the present embodiment, display interface 376 includes five elements: electronic programming guide information 381, search engine 382, email 383, video information 384, and web page 385. Elements 381-385 function in part by combining information from the Internet with information from the digital broadcast signal to provide the user with a seamless, interactive, display of information regarding the content being displayed on television 375.

For example, the electronic programming guide information 381 provides a list of available programming identified by channel and time. Search engine 382, provides a search ability that allows the user to, for example, search for specific programming by subject, title, content, etc. Video information 384 shows the actual video of, for example, the currently selected channel being viewed by the user. Web page 385 shows a specific web page corresponding to, for example, the program being broadcast on the currently selected channel in the video information "window" 384. Email 383 shows, for example, a list of

the most currently transmitted or received e-mails of the user, or an e-mail message currently being edited.

Referring still to Figure 2, in the present embodiment, the user interacts with display interface 376 via, for example, a cursor controlled with a remote control (not shown), or alternatively, via buttons on the remote control or remote keyboard. The user interacts with the display interface 376 by selecting and actuating the various elements 381-385 or portions thereof. As the user interacts with the display interface 376, the transceiver 300 recognizes the user input. The user input is transmitted upstream using the cable modem 104, and the display interface is altered in accordance with the user input, if required (e.g., the user selects a new channel for viewing in video information window 384, the user selects a new e-mail message in e-mail window 383, the user selects a new web page for a new program in web page window 385, etc.).

In this manner, transceiver 300 of the present invention provides a display interface 376 which efficiently presents information regarding broadcast data available to the user. By combining information from the Internet (e.g., elements 381-383 and element 385) with an actual video signal (e.g., video information window 384) in a single display, transceiver 300 of the present embodiment provides a comprehensive display interface 376 which allows the user to efficiently analyze and sift through the myriad of various viewing/listening choices available. For example, the user is able to access an unlimited number of web pages (e.g., web page window 385) specifically tailored to each available viewing or listening choice.

In addition, as a method of enhancing the information from the electronic programming guide window 381, the web pages viewable in web page window 385 can include numerous types of specific information regarding programming availability, cost (if any), program specific information describing the actual content of program (e.g., synopsis, summary, rating guide, etc.), or the like. For example, due to the nature of the Internet, the most popular programs often have dozens of Internet sites related to their respective content (e.g., official web sites, fan based web sites, etc.).

As another added benefit over conventional electronic programming guide information, the display interface of transceiver 300 can provide "active" assistance to the user. Transceiver 300 can be described as being "intelligent," in that much of the functionality of transceiver 300 and of display interface 376 is software based. As such, transceiver 300 is capable of providing active assistance to the user, for example, by identifying programming choices of interest, and recognizing the user's history of identifying choices of interest and displaying additional programming the user would be likely to find interesting (based on that history). In so doing, transceiver 300 of the present invention is intelligent and capable of taking predetermined actions based upon the user's history, interests, etc.

Figure 3A shows an overview diagram depicting the relationship of transceiver 300 to the broadcast means of the digital broadcast system operator (also referred to as a Multiple System Operator, MSO). As depicted in Figure 3A, digital broadcast signal 370 and Internet protocol signal 371 can be delivered to transceiver 300 using any of the various mechanisms currently in use or envisioned, such as a terrestrial line (e.g., a coaxial cable 372), a wireless

transmission (e.g., a satellite broadcast or terrestrial broadcast), or the like. This is depicted in Figure 3A, for example, as digital broadcast signal 370a from internet/cable 391 and digital broadcast signal 370b from satellite/terrestrial broadcast 392.

Figure 3B is an illustration of the various frequencies associated with the in-band signals and out-of-band signals of the digital broadcast signal and the cable modem signal (e.g., the internet protocol signal) in accordance with one embodiment of the present invention. In this embodiment, the frequencies in the range of approximately 5-42 MHz are known as "upstream" signals, and the frequencies in the range of approximately 54-860 MHz are known as "downstream" signals. Within the upstream range, the range of frequencies from approximately 5-26 MHz are known as "out-of-band (OOB) upstream" and the range from 27-42 MHz are known as "in-band upstream," or "cable modem upstream." Within the downstream range, the range of frequencies from approximately 70-130 MHz are known as "out-of-band downstream" with the remainder being in-band downstream.

With regard to transceiver 300, only in-band signals (upstream and downstream) are transmitted and received. Additionally, upstream communication is primarily handled by the cable modem 104. However, in other embodiments (e.g., transceiver 600 of Figure 6) both in-band signals and out-of band signals can be used.

Figure 4 shows a more detailed diagram of a transceiver 400 (e.g., a set-top box) in accordance with one embodiment of the present invention. In the present embodiment, transceiver 400 includes a front-end block 310 coupled to

bus 305, interface card 330 coupled to front-end block 310 and bus 305, audio/video (A/V) decode block 340 coupled to interface card 330 and bus 305, graphics block 350 coupled to A/V decode block 340 and bus 305, and central processing unit 360 coupled to bus 305. Interface card 330, also referred to as a point of deployment (POD), is adapted to receive smart card 325.

Transceiver 400 is substantially similar to transceiver 300 of Figure 1, however transceiver 400 of Figure 4 depicts the internal components in greater detail. Transceiver 400 receives digital broadcast signal 370 and Internet protocol signal 371 via a separate front end block 310 and is transmitted to interface card 330 for descrambling and subsequent transmission to A/V decode block 340.

Referring still to Figure 4, in the present embodiment, front-end block 310 contains one or more tuners for receiving digital broadcast signal 370. For example, in one embodiment, front-end block 310 contains a single "in-band" tuner for receiving in-band digital broadcast signals and a cable modem (e.g., cable modem 104) for receiving Internet protocol signals, or alternatively a telephone type device (e.g., digital subscriber line) similarly allowing connection to be made to the World Wide Web so that Internet information or even broadcast signals can be received via the Internet. In another embodiment, front-end block 310 contains a tuner for receiving a wireless transmission (e.g., a satellite broadcast) and another tuner for receiving a cable transmission.

Smart card 325 stores information (e.g., information from the cable head-end) needed by a cable system operator or digital broadcast system operator (e.g., a Multiple System Operator, MSO) in order to bill a subscriber

for services used by the subscriber (for example, the viewing of a pay-per-view movie or event). Typically, smart card 325 also includes a key that is used to descramble digital broadcast signal 370 (if the signal is scrambled). In the present embodiment, smart card 325 is inserted into interface card 330; however, it is appreciated that in other embodiments smart card 325 may be coupled in a different manner to intelligent transceiver 300 (for example, it may be inserted into either front-end block 310 or A/V decode block 340). Using the key from smart card 325, interface card 330 descrambles digital broadcast signal 370.

Because digital broadcast signal 370 is often scrambled to protect valuable copyrighted information included in the signal, the resulting data stream is encrypted in order to prevent its unauthorized use and duplication. In the present embodiment, interface card 330 contains an encryption unit (not shown) that encrypts digital broadcast signal 370. In one embodiment, the encryption unit uses a well-known DES ECB (Data Encryption Standard Electronic Code Book) encryption routine and a key length of 56 bits. However, it is appreciated that other well-known and commercially available encryption routines and different key lengths may be used in accordance with the present invention.

In the present embodiment, A/V decode block 340 is an integrated circuit device comprising a functional block and a encryption unit 345 integrated therein. Encryption unit 345 is integral with A/V decode block 340 (that is, as a single integrated circuit, or "chip") and coupled to front-end block 310 via interface card 330. In this embodiment, the link between interface card 330 and A/V decode block 340 (specifically, encryption unit 345) is

separate from bus 305; that is, there is a direct connection between interface card 330 and encryption unit 345 that bypasses bus 305. Encryption unit 345 decrypts an encrypted signal (e.g., digital broadcast signal 370) received by A/V decode block 340. The output of encryption unit 345 is a decrypted digital signal that is "in the clear." The signal in the clear is transmitted within A/V decode block 340 for decoding. To preserve security, the clear signal is encrypted by encryption unit 345 prior to transmission outside of A/V decode block 340.

In this manner, transceiver 400 provides a secure interface between interface card 330 and encryption unit 345 and also between encryption unit 345 and A/V decode block 340, and thus between front-end block 310 and A/V decode block 340. As such, transceiver 400 can prevent pirating of a descrambled and decrypted digital signal.

A/V decode block 340 receives encrypted digital broadcast signal 370 from interface card 330, decrypts the signal using encryption unit 345, and decodes the video content and the audio content of digital broadcast signal 370. In the present embodiment, an MPEG (Moving Pictures Experts Group) video decoder and an AC3 (Digital Dolby) audio decoder are used; however, it is appreciated that other video or audio decoders can be used in accordance with the present invention. In addition, in one embodiment, A/V decode block 340 is capable of handling video and audio analog signals.

Figure 5 is a block diagram of a transceiver 500 in accordance with another embodiment of the present invention. In this embodiment, point of deployment (POD) 320 is separate from interface card 330, and smart card

325 is plugged into POD 320 instead of interface card 330. In this embodiment, however, smart card 325 contains a key for descrambling digital broadcast signal 370, and this key is used by POD 320 to descramble digital broadcast signal 370. POD 320 also encrypts digital broadcast signal 370 using an encryption engine (not shown). Although POD 320 is separate from interface card 330 in this embodiment, interface card 330 can still exist in transceiver 500.

Figure 6 is a block diagram of a transceiver 600 (e.g., a bi-directional set-top box) showing additional details of the embodiments illustrated by Figure 4 and Figure 5. Table 1 is a list of the various elements and acronyms contained in Figure 6.

Table 1

Elements and Acronyms of Transceiver Embodied in Figure 6

| | |
|---|---|
| AVDAC | Audio Video Digital-to-Analog Converter |
| BTSC | Broadcast Television Systems Committee |
| D-Cache | Data Cache |
| DAVIC | Digital Audio/Video Interface Connector |
| DOCSIS | Data Over Cable Service Interface Specification |
| DSM | Diplexer, Splitter and Modulator |
| DSP | Digital Signal Processor |
| DVD | Digital Video Disk |
| FAT | Forward Application Tuner |
| FPU | Floating Point Unit |

| | |
|---|---|
| I/F | Interface |
| IDCT | Inverse Discrete Cosine Transform |
| Inst. Cache | Instruction Cache |
| Int. Cont. | Interrupt Controller |
| MAC | Media Access Control |
| MC | Motion Compensation |
| MCNS | Multiple Cable Network System |
| MIDI | Musical Instrument Digital Interface |
| MP@ML | Main Profile at Main Level |
| OOB | Out-of-band |
| PCI | Peripheral Component Interconnect |
| PCM | Phase Control Modulation |
| PLL | Phase Lock Loop |
| QPSK | Quadrature Phase Shift Keying |
| QPSKQAM | QPSK Quadrature Amplitude Modulation |
| RTC | Real Time Clock |
| SLIC | Serial Line Internet Connection |
| UART | Universal Asynchronous Receiver-Transmitter |
| VBI | Vertical Blanking Interval |
| VIF/SIF | Video Intermediate Frequency/Sound Intermediate Frequency |

With reference to Figure 6, in the present embodiment, front-end block 310 receives a scrambled digital broadcast signal (e.g., digital broadcast signal 370 of Figure 1) from a digital broadcaster via in-band tuner 401, OOB tuner

402 and/or MCNS FAT tuner 403. Front-end block 310 also receives an Internet protocol signal (e.g., Internet protocol signal 371 of Figure 1) via MCNS FAT tuner 403. The signals are received via DSM 610. Smart card 325 includes a key to descramble the digital broadcast signal. It is appreciated that Figure 4 shows some elements from the embodiments illustrated by Figures 1, 4, and 5. In the case of the embodiment illustrated by Figure 4, smart card 325 is inserted into interface card 330, and interface card 330 descrambles and encrypts the digital broadcast signal. In the case of the embodiment illustrated by Figure 5, smart card 325 is plugged into POD 320. In this latter embodiment, the descrambling and encrypting functions are performed in POD 320, and so these functions are bypassed in interface card 330.

MCNS FAT tuner 403 is used implement the cable modem functionality of front-end block 310. MCNS FAT tuner 403 functions in substantially the same manner as cable modem 104 of Figure 1.

Continuing with reference to Figure 6, the encrypted digital signal is delivered to A/V decode block 340 via interface card 330. In the present embodiment, decryption engine 345 is integrated into demultiplexer ("demux") 410, which is itself integrated into A/V decode block 340. Decryption engine 345 contains an decryption engine for decrypting digital broadcast signal 370. Decryption engine 345 is integral with A/V decode block 340 and is coupled to front-end block 310 via interface card 330. Decryption engine 345 decrypts an encrypted signal (e.g., digital broadcast signal 370) received by A/V decode block 340 via interface card 330. The in-the-clear signal is immediately transmitted within the integrated circuit of A/V decode block 340 for decoding.

The in-the-clear signal is not transmitted outside the physical block comprising A/V decode block 340 and decryption engine 345. In the present embodiment, decryption engine 345 provides the interface between A/V decode block 340 and interface card 330. It is appreciated that in other embodiments integrated circuit 345 may be integrated into A/V decode block 340 in some different manner (that is, in a location other than demux 410) while still providing the interface with interface card 330.

Continuing with reference to Figure 6, in the present embodiment, A/V decode block 340 includes an MPEG decoder (e.g., graphics block 411) and an audio decoder (e.g., AC-3 block 412) to decode the video and audio content of digital broadcast signal 370. Graphics block 350 processes the audio and video information received from A/V decode block 340. Central processing unit 360 contains a microprocessor (e.g., CPU core 430) and memory (e.g., instruction cache 420) for processing information and instructions used by intelligent transceiver 400.

Referring now to Figure 7, a flow chart of the steps of a process 700 in accordance with one embodiment of the present invention is shown. Process 700 depicts the basic operating steps of interactive display interface generation process as implemented in a set-top box transceiver in accordance with one embodiment of the present invention (e.g., transceiver 300 of Figure 1 or transceiver 600 of Figure 6).

Process 700 begins in step 701, where a digital broadcast signal is received by transceiver 300. As described above, the digital broadcast signal is transmitted from an MSO. The digital broadcast signal (e.g., digital broadcast

signal 370 of Figure 1) conveys audio video content for display/consumption by a user on, for example, a coupled television (e.g., television 375 of Figure 1).

In step 702, the digital broadcast signal is descrambled using descrambling circuits. As described above, the digital broadcast signal is transmitted from the MSO in a scrambled form to prevent unauthorized reception by "pirating" users. An authorized user can descramble the digital broadcast signal using a key provided by the MSO. Depending upon the particular transceiver embodiment, the descrambling functionality can be included in an A/V decode block (e.g., transceiver 300 of Figure 1), or a separate interface card (e.g., interface card 330 of Figure 4).

In step 703, an Internet protocol signal (e.g., Internet protocol signal 371 of Figure 1) is received by a cable modem (e.g., cable modem 104 of Figure 1 or MCNS FAT tuner 403 of Figure 6) included in the transceiver. As described above, the Internet protocol signal is used to convey a variety of Internet based information. Such information includes, for example, e-mail, electronic programming guide information (e.g., name of the program, showtime, channel its on, etc.), Web sites, and the like.

Referring still to process 700 of Figure 7, in step 704, the transceiver generates a display interface. As described above, the video information from the digital broadcast signal and the Internet information from the Internet protocol signal are combined into a single comprehensive display interface. In one embodiment, the generating functionality is implemented via software executing on a CPU block (e.g., CPU 360 of Figure 6) included in the transceiver. The particular configuration of the display interface varies in

accordance with the requirements of the user. For example, where the user is interested in watching a particular video program, Internet information related to the video program (e.g., program synopsis, program ratings, etc.) is combined into the interactive display (e.g., display interface 376 of Figure 2).

In step 705, the generated display interface is coupled to a graphics block (e.g., graphics block 350 to Figure 6) included in the transceiver. The graphics block processes the display interface data received from the AV decode block and the CPU to generate a resulting video signal and audio signal compatible with the coupled display device (e.g., television 375).

In step 706, the video signal and the audio signal generated in step 705 are coupled to the display device for viewing by the user. In so doing, the display interface generated by the transceiver is "rendered" for viewing by the user.

In step 707, the transceiver recognizes any user input via the interactive display interface. As described above, user input is recognized via, for example, the user interacting with the display interface by manipulating a cursor controlled with a remote control, or alternatively, for example, via buttons on the remote control or remote keyboard.

In step 708, as the user interacts with the display interface by selecting and actuating the various elements or portions thereof, the resulting user input is transmitted upstream using the cable modem.

In step 709, depending upon the particular input, the display interface is altered accordingly. Such input can be, for example, the user selecting a new channel for viewing in a video information window of the display interface (e.g., video information window 384 of Figure 2), the user selecting a new e-mail message (e.g., in e-mail window 383), the user selecting a new web page for a new program (e.g., in web page window 385) and the like. For example, the user can select an embedded "hyperlink" in the web page to obtain more detailed information regarding the content in the video information window (e.g., to obtain a biography of one of the program's stars, to obtain statistics on a player in a sporting event, etc.).

Thus, the present invention provides a method and system for a bi-directional transceiver that combines Internet information with video information to create an interactive display interface for viewing by a user. The present invention generates a comprehensive display interface which allows the user to efficiently analyze and sift through the various viewing/listening choices available. The display interface of the present invention is interactive and is capable of providing active assistance to the user in identifying choices of interest. Through the display interface, the transceiver of present invention can recognize user input as the user identifies choices of interest and selects programming the user finds interesting. In addition, the transceiver of the present invention is intelligent and capable of taking predetermined actions based upon the user history, interests, etc., and is intuitively obvious to use.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description.

They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.

CLAIMS

What is claimed is:

1. In a bi-directional cable television set-top box transceiver, a method for combining internet information with video information to create an interactive display interface for viewing by a user, the method comprising the steps of:

a) receiving an in-band portion of a digital broadcast signal using an in-band tuner;

b) decoding a data stream from the in-band tuner into a resulting video signal, the decoding performed by an audio video decoder;

c) implementing bi-directional communication based upon internet protocols using a cable modem;

d) generating a display interface including video from the video signal and a web page from the cable modem, the display interface for viewing on a display device; and

e) transmitting the user input up-stream to a cable head-end using the cable modem as the user interacts with the display interface.

2. The method of claim 1 further comprising the step of receiving the video from a cable head-end of an MSO (multiple system operator).

3. The method of claim 1 wherein the display device is a television monitor and the display interface is viewed by the user on the television monitor.

4. The method of claim 1 further comprising the step of receiving a descrambling key for descrambling the video from the video signal via the cable modem.

5. The method of claim 1 further comprising the step of encrypting the video using an encryption routine substantially compliant with DES ECB (Data Encryption Standard Electronic Code Book).

6. The method of claim 1 wherein the web page includes programming guide information regarding the content of the digital broadcast signal.

7. The method of claim 1 further comprising the step of changing the web page in accordance with the user input wherein the user provides input via a remote control.

8. The method of claim 1 further comprising the step of changing the video from the video signal in accordance with the user input wherein the user provides input via a remote control.

9. The method of claim 1 further including the step of receiving an out-of-band portion of the digital broadcast signal using an out-of-band tuner.

10. A bi-directional transceiver for combining internet information with video information to create an interactive display interface, comprising:

a tuner for receiving a digital broadcast signal and generating a data stream therefrom;

an audio video decoder for decoding the data stream into a resulting video signal;

a cable modem for bi-directional communication using internet protocols; and

a CPU (central processing unit) for managing the operation of the tuner, the audio video decoder, and the cable modem, the CPU for causing the transceiver to perform the steps of:

a) generating a display interface including video from the video signal and a web page from the cable modem;

b) recognizing user input as the user interacts with the display interface; and

c) transmitting the user input up-stream using the cable modem.

11. The transceiver of claim 10 wherein the tuner is an in-band tuner, the in-band tuner included in a front end for tuning and demodulating an in-band portion of the digital broadcast signal.

12. The transceiver of claim 11 further comprising an out-of-band tuner included in the front end for tuning and demodulating an out-of-band portion of the digital broadcast signal.

13. The transceiver of claim 11 wherein the cable modem is included in the front end.

14. The transceiver of claim 10 wherein the internet information is received via the internet from a content provider.

15. The transceiver of claim 10 wherein the internet information includes programming guide information regarding the content of the digital broadcast signal.

16. The transceiver of claim 10 wherein the video information includes a video stream of a video program from a cable head-end.

17. The transceiver of claim 10 wherein the display interface is coupled to a television monitor for viewing by the user.

18. The transceiver of claim 10 wherein the transceiver is a set-top box.

19. The transceiver of claim 10 wherein the user provides the user input via the remote control in order to change the web page in accordance with the user input.

20. The transceiver of claim 10 wherein the user provides the user input via the remote control in order to change the video from the video signal in accordance with the user input.

21. A bi-directional cable television set-top box transceiver for combining internet information with video information to create an interactive display interface for viewing by a user, comprising:

an in-band tuner for receiving an in-band portion of a digital broadcast signal;

an out-of-band tuner for receiving an out-of-band portion of the digital broadcast signal;

an audio video decoder for decoding a data stream from the in-band tuner and the out-of-band tuner into a resulting video signal;

a cable modem for bi-directional communication using internet protocols; and

a CPU (central processing unit) having a processor coupled to a memory, the memory storing computer readable code which when executed by the processor cause the transceiver to perform the steps of:

a) generating a display interface including video from the video signal and a web page from the cable modem, the display interface for viewing on a display device;

b) recognizing user input as the user interacts with the display interface; and

c) transmitting the user input up-stream to a cable head-end using the cable modem.

22. The transceiver of claim 10 or 21 wherein the video is received from a cable head-end of an MSO (multiple system operator).

23. The transceiver of claim 21 wherein the display device is a television monitor and the display interface is viewed by the user on the television monitor.

24. The transceiver of claim 10 or 21 wherein a descrambling key for descrambling the video from the video signal is received via the cable modem.

25. The transceiver of claim 21 wherein the video is encrypted using an encryption routine substantially compliant with DES ECB (Data Encryption Standard Electronic Code Book).

26. The transceiver of claim 21 wherein the web page includes programming guide information regarding the content of the digital broadcast signal.

27. The transceiver of claim 21 wherein the user provides the user input via the remote control in order to change the web page in accordance with the user input.

28. The transceiver of claim 21 wherein the user provides the user input via the remote control in order to change the video from the video signal in accordance with the user input.

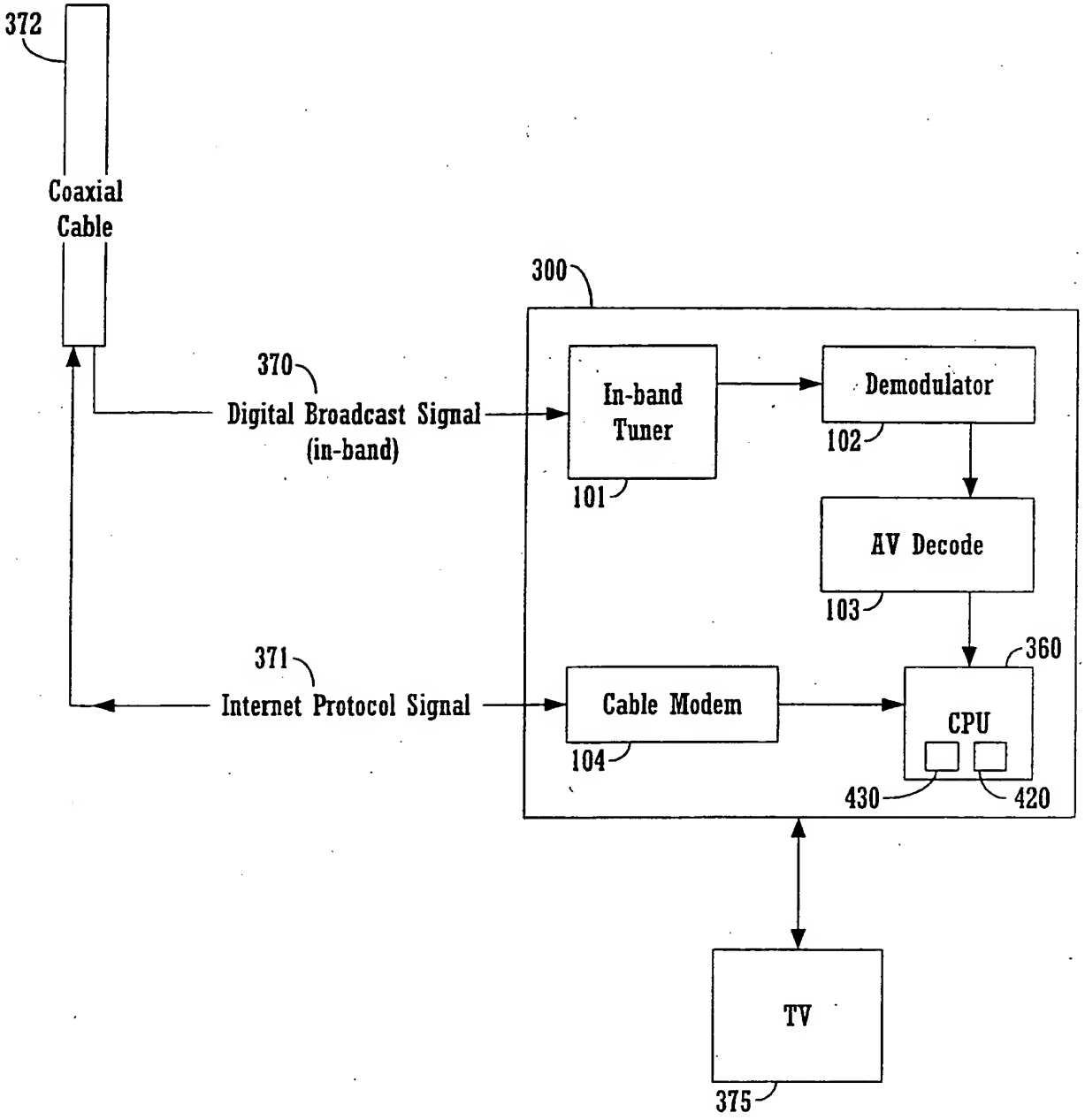
372
Coaxial Cable
300
370
Digital Broadcast Signal (in-band)
In-band Tuner
101
Demodulator
102
AV Decode
103
360
371
Internet Protocol Signal
Cable Modem
104
CPU
430
420
TV
375

FIGURE 1

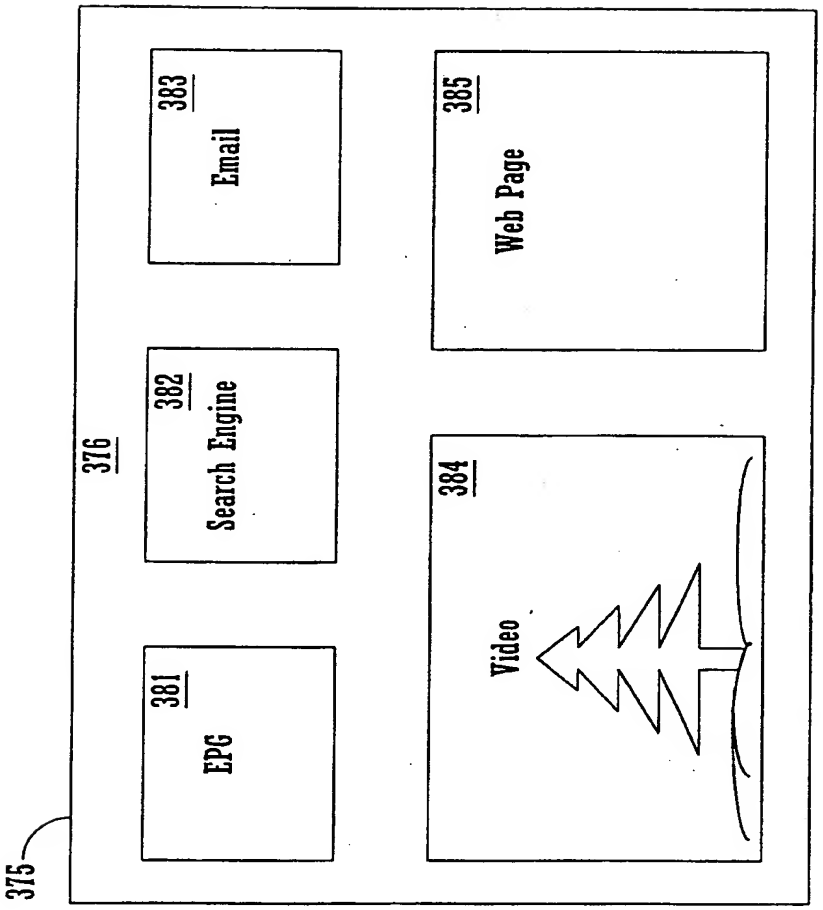
375
376
381
EPG
382
Search Engine
383
Email
384
Video
385
Web Page

FIGURE 2

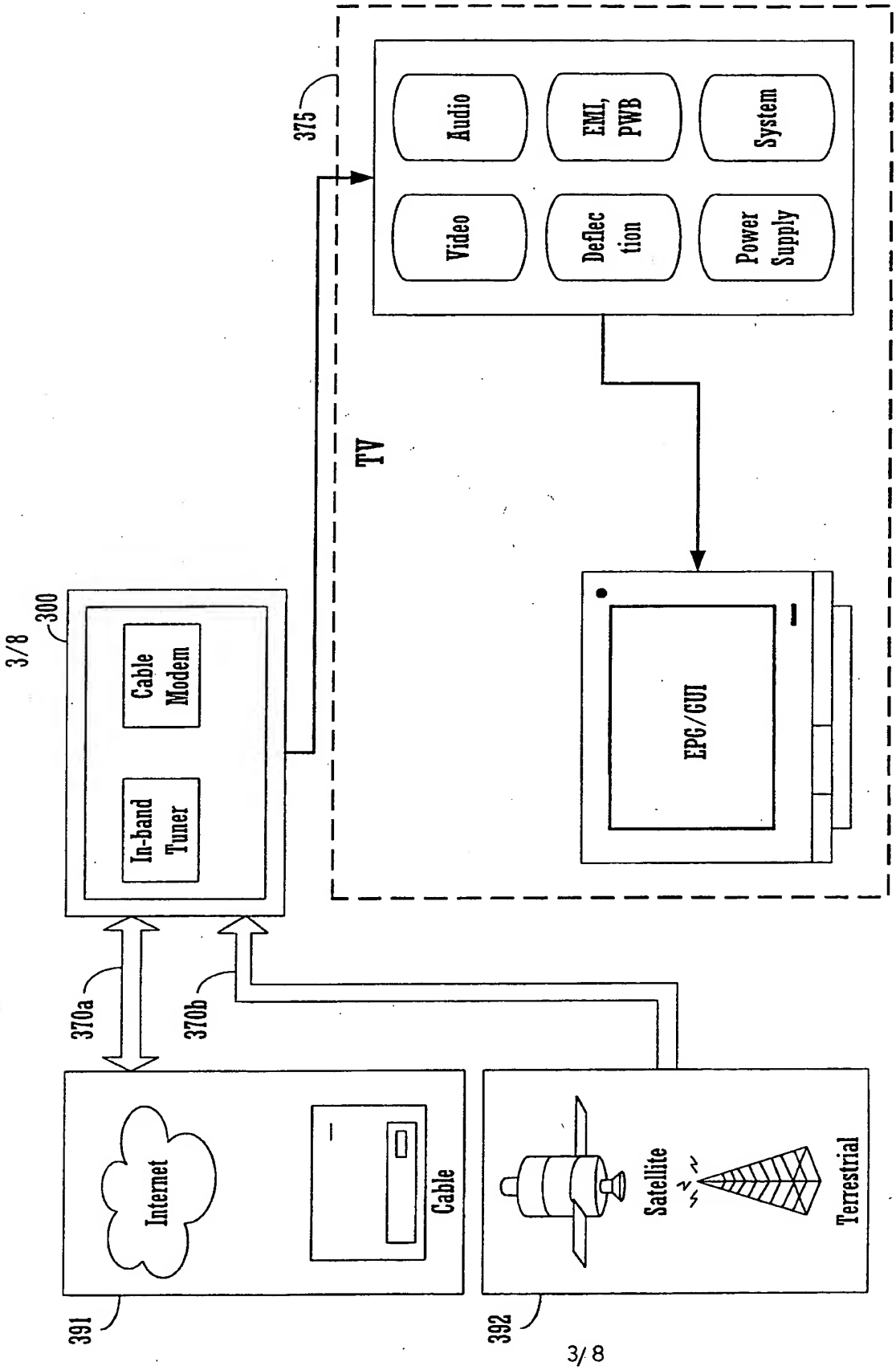
375
Audio
EMI, PWB
System
Video
Deflec tion
Power Supply
TV
EPG/GUI
300
Cable Modem
In-band Tuner
370a
370b
Internet
Cable
391
Satellite
Terrestrial
392

FIGURE 3A

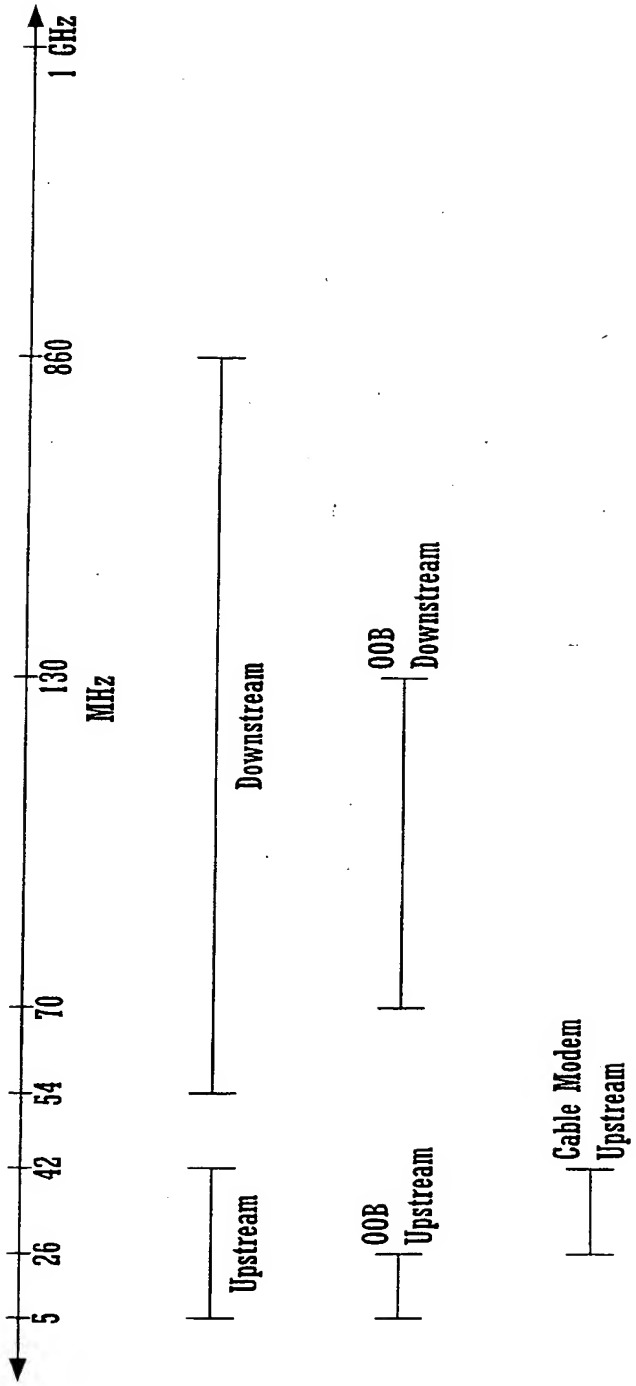
1 GHz
860
130
MHz
70
54
42
26
5
Downstream
Upstream
OOB
Downstream
OOB
Upstream
Cable Modem
Upstream

FIGURE 3B

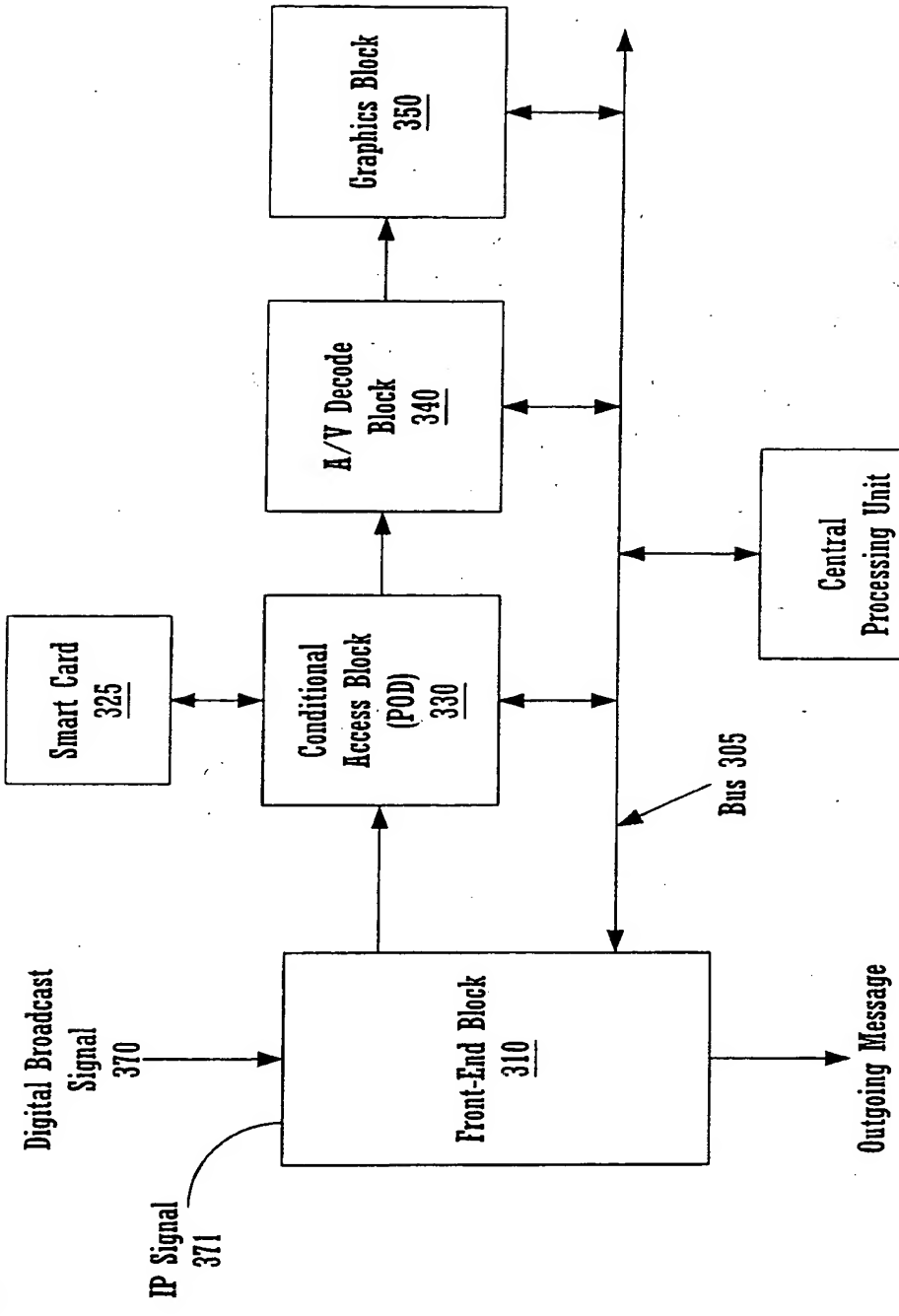
Graphics Block
350
A/V Decode
Block
340
Central
Processing Unit
360
Smart Card
325
Conditional
Access Block
(POD)
330
Bus 305
Digital Broadcast
Signal
370
Front-End Block
310
Outgoing Message
IP Signal
371
400

FIGURE 4

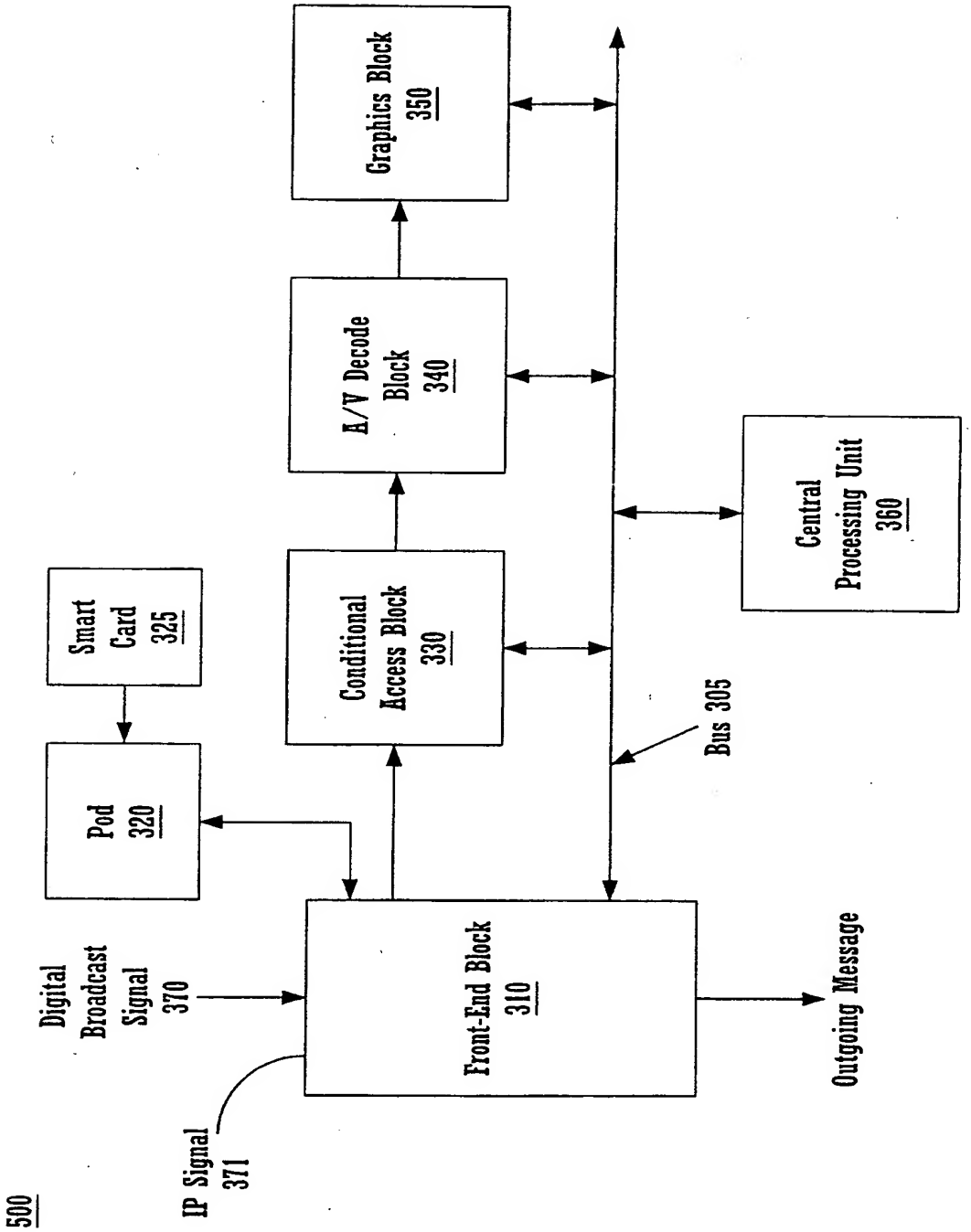
500
IP Signal 371
Digital Broadcast Signal 370
Front-End Block 310
Outgoing Message
Pod 320
Smart Card 325
Conditional Access Block 330
A/V Decode Block 340
Graphics Block 350
Central Processing Unit 360
Bus 305

FIGURE 5

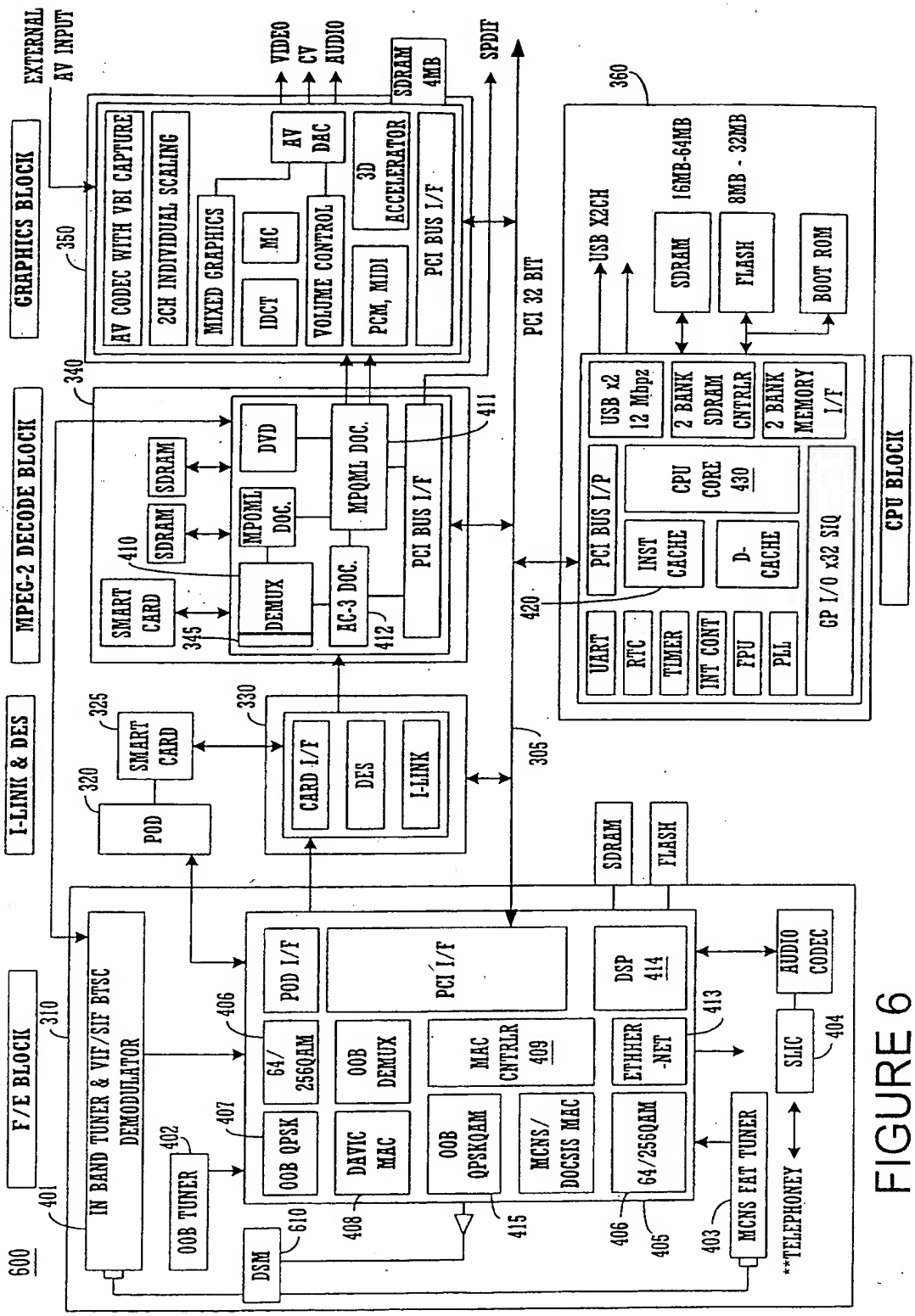
600
F/E BLOCK
401
IN BAND TUNER & VIF/SIF BTSC DEMODULATOR
310
OOB TUNER
402
DSM
610
OOB QPSK
407
64/256QAM
406
DAVIC MAC
408
OOB QPSKQAM
415
MCNS/DOCSIS MAC
POD I/F
PCI I/F
MAC CNTRLR 409
OOB DEMUX
ETHHER-NET
413
64/256QAM
406
405
MCNS FAT TUNER
403
**TELEPHONEY
SLIC
404
DSP 414
AUDIO CODEC
SDRAM
FLASH
I-LINK & DES
POD
320
SMART CARD
325
CARD I/F
DES
I-LINK
330
305
MPEG-2 DECODE BLOCK
340
SMART CARD
345
410
SDRAM
SDRAM
MPOML DOC.
DEMUX
DVD
MPQML DOC.
AC-3 DOC.
412
PCI BUS I/F
411
GRAPHICS BLOCK
EXTERNAL AV INPUT
350
AV CODEC WITH VBI CAPTURE
2CH INDIVIDUAL SCALING
MIXED GRAPHICS
IDCT
MC
VOLUME CONTROL
PCM, MIDI
3D ACCELERATOR
PCI BUS I/F
AV DAC
SDRAM 4MB
VIDEO
CV
AUDIO
SPDIF
PCI 32 BIT
420
CPU BLOCK
360
USB X2CH
16MB-64MB
8MB - 32MB
SDRAM
FLASH
BOOT ROM
USB x2 12 Mbps
2 BANK SDRAM CNTRLR
2 BANK MEMORY I/F
PCI BUS I/P
CPU CORE 430
INST CACHE
D-CACHE
GP I/O x32 SIO
UART
RTC
TIMER
INT CONT
FPU
PLL

FIGURE 6

7/8

700

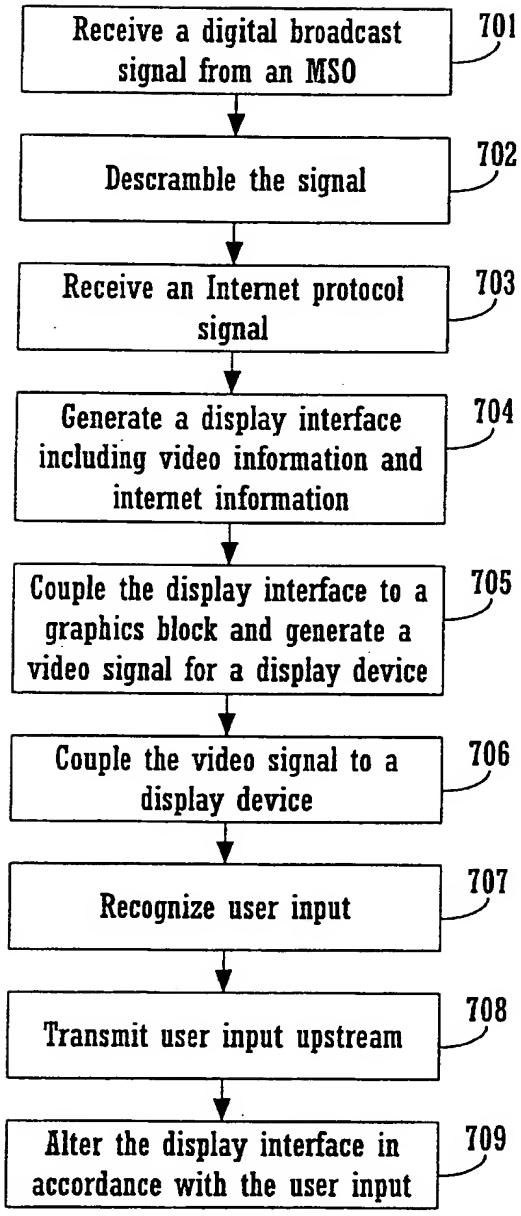
Receive a digital broadcast signal from an MSO
701
Descramble the signal
702
Receive an Internet protocol signal
703
Generate a display interface including video information and internet information
704
Couple the display interface to a graphics block and generate a video signal for a display device
705
Couple the video signal to a display device
706
Recognize user input
707
Transmit user input upstream
708
Alter the display interface in accordance with the user input
709

FIGURE 7

# INTERNATIONAL SEARCH REPORT

Ir ıational Application No
PCT/US 00/33455

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/445 H04N7/167 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 99 18718 A (THOMSON CONSUMER ELECTRONICS) 15 April 1999 (1999-04-15)<br>page 3, line 24 -page 12, line 34; figure 1 | 1-4, 6-24, 26-28 |
| A | GB 2 322 528 A (MOTOROLA INC) 26 August 1998 (1998-08-26)<br>the whole document | 1-28 |
| A | WO 99 48287 A (SCHNEIDEWEND DANIEL RICHARD ;GRIMES KEVIN LLOYD (US); THOMSON CONS) 23 September 1999 (1999-09-23)<br>page 5, line 6 - line 38; figure 1A<br>page 7, line 13 -page 8, line 35; figure 1B | 1-28 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

'E' earlier document but published on or after the international filing date

'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

'O' document referring to an oral disclosure, use, exhibition or other means

'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 2 April 2001 | 07/05/2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | De Paepe, W |

1

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 00/33455

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
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| | | AU 9678698 A | 27-04-1999 |
| | | CN 1273731 T | 15-11-2000 |
| | | CN 1273738 T | 15-11-2000 |
| | | EP 1020059 A | 19-07-2000 |
| | | WO 9918703 A | 15-04-1999 |
| GB 2322528 A | 26-08-1998 | AU 5268098 A | 27-08-1998 |
| | | BR 9800712 A | 29-06-1999 |
| | | DE 19806685 A | 03-09-1998 |
| WO 9948287 A | 23-09-1999 | AU 3192199 A | 11-10-1999 |
| | | EP 1062805 A | 27-12-2000 |